

Pollen Morphology Study for Tow Genus Carex L. and Cyperus L. In Iraq

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Abstract: *In present study, micromorphology of pollen grains characteristics of tow genus belonging to cyperaceae family, which included four species of Cyperus L. which it (C.difformis L., C.rotundus L., C.odoratus L.) , And two species of Carex L. which it (Carex diluta ,Carex pachystylis), The samples were collected from different region of Iraq , The study examined the Micromorphology of the pollen and showed variations, which helped to isolate the taxa at the level of genera and species, where the results of observations show that the characters studied (Polar axis length (P) , Length Equatorial axis(E), Rate P/E, Number of aperture , Thickness of the Exine layer, Shape pollen, Pollen layer under light microscope), The results showed that there was a variance of most of the above-mentioned traits. The pollen shape showed was in two shapes: Oblate Spheroidal and Sub Oblate . At the level of the size, C.rotundus recorded the largest size of the pollen which isolated from other species while the species Cyperus difformis the smallest size ,also result indicate a good quantitative relationship between surface pollen assemblages and local vegetation Significant differences in diversity of pollen flora, pollen amounts. spatial differences of pollen assemblages are relevant to different regional topography and climatic conditions. The rest of the traits were also given, taxonomic importance in isolating species from one another.*

Keywords: *Cyperaceae, pollen grain, Cyperus L. , Carex L., palynology.*

1. INTRODUCTION

The genus Carex L. and Cyperus L. belong to Cyperaceae family, which is considered one of the monocotyledons families and is considered one of the large families with multiple genus and is spread in all parts of the world [1] , especially in the temperate and subtropical regions, It was also noted that species of family spread in wet areas, marshes and swamps [2] and [3] . The first who classify the family and divide it into two sub family is the scientist De-Jussieu, depending on the sex of the flowers, and based on the molecular studies carried out by [4] , Cyperaceae family was placed with the two families of the Juncaceae and Poaceae within the order of Poaceae, as for the number of its genus and species, it was mentioned most researchers say it includes (104) genus and (5,000) species, In Iraq, [5] mentioned in 1998 that the family has 50 genus and 3,500 species spread in wet areas, river banks and marshes [6] and [7] . The study of pollen has a taxonomic and ecological importance, as its importance has emerged taxonomically to determine the evolutionary and natural relationships between genus and plant families by studying some of their characteristics such as the dimensions of pollen grains, the number of holes and grooves, and other characteristics that helped in identifying refined plants and the developed characteristics from primitive ones [8], And explain the evolutionary origin and determine the ancestors and their environment

[9] and [10] . As for the importance of studying pollen in the field of the environment, fossilized pollen grains were studied and compared to modern ones, which helped in the study of the environment in the past, as a group of scientists indicated that there is a quantitative relationship between pollen grains and vegetation cover, They noticed a relationship between pollen aggregation and local plants for that geographical area, as there were statistical differences in the diversity and quantity of pollen grains and the main varieties of that region, They pointed out that the difference in pollen aggregation is due to the difference in climatic conditions and topography of the areas in which these varieties exist [11] and [12] . Among the recent studies is the study of [13] , [14] , [15] and [16] , which dealt with the study of the quantitative and qualitative characteristics of pollen grains, such as pollen grain shape, size, diameter, number of holes and grooves, wall thickness, surface decoration pattern, and fertility percentage.

2. MATERIAL AND METHODS

Preparation of pollen using optical microscopy

This study included fresh samples collected from the field and dry samples from the herbarium which were diagnosed by [17, 18].

Preparation of the slides: Method of [19] was followed in the preparation of pollen samples as follow :

- 1- Took the mature anthers of floral of the studied species were taken and placed in boiling water for 2-3 minutes in order to soften them. Then they were transferred to a clean slide and then cut into small pieces with a sharp blade for liberating pollen grains from the anthers. As for the fresh samples, they were used immediately after opening the anthers and placed on the slide.
- 2- Added drop of the dye (safranin - glycerine) after remove the remains of the stalk and then put the cover slide gently, so the slide is ready for examination and kept in the refrigerator at a temperature 4°C until the examination.
- 3- Measurements were made using the Ocular micrometer of optical microscopy after calibration. All measurements were taken with the polar and equatorial view, as well as the thickness of the wall and the length of the aperture. The measurements were taken using the oil lens 40 X. The number of samples studied ranged from (2 - 15) samples for each species studied . As well, the number of measurements used in the study of appearance was between (5 - 20) measurements for each trait.

3. RESULT

The current study showed through the Table (1) Panel (1) for pollen grains a clear contrast in the quantitative and qualitative characteristics of the studied species, which benefited in isolating the species and separating them from others, and among the qualitative characteristics that the study dealt with is the shape of the pollen grain in the Equatorial view, The species *Carex pachystylis* was distinguished by its pollen grains having a Peariform shape, also species *Cyperus difformis* was recognized by its pollen grains having a Triangular shape, also species *Cyperus odoratus* definitions in the Rhomboidal shape ,while species *Carex diluta* and *Cyperus rotundus* had a Rectangular - Triangular rectangular shape . As for the shape of the pollen grains in the polar view, the species were divided into two groups: The first group had the pollen grains of Rhomboidal shape to Rhomboidal Triangular represented by the species, while the second group had the pollen grains of Circular shape represented by the species. Among the specific characteristics that were also studied is the

characteristic of the nature of the pollen grain under the light microscope, depending on the extent of its response to the dye, as it ranged from thin or clear to dark dye, as the species were divided based on this characteristic into two groups, the first clear group, which was represented by the species, *Carex diluta*, *Cyperus difformis* and *Cyperus rotundus*, and the second group, the dark dye, which was represented by the two species, *Cyperus odoratus* and *Carex pachystylis*. The General shaped of the pollen was based on the ratio between the diameter of the polar axis / Equatorial axis (P / E). From table (2) the species *Cyperus difformis* was distinguished by its shape Oblate Spheroidal from the rest of the species, and thus it was isolated from it. The rest of the species, *Carex diluta*, *Cyperus odoratus*, *Carex pachystylis* and *Cyperus rotundus*, the pollen grains shape were sub oblate. In addition to the qualitative traits, the quantitative traits of pollen grains were studied, including the characteristic of the thickness of the Exine layer of the pollen grain, whereas the species *Cyperus odoratus* recorded the largest wall thickness, which ranged between (3.5-5) μm and the average about (3.7) μm . While species *Carex diluta* recorded the least thickness of the pollen grain wall, which ranged between (2-2.5) μm and an average about (2.3) μm . The rest of the species overlapped with each other in the values of wall thickness. Table (2) Panel (1). Among the quantitative characteristics that were also studied is the characteristic of the length of the polar axis of the pollen grain, which helped to separate the species and isolate them from others, as the species *Cyperus rotundus* was distinguished by being isolated from the rest of the species, as it recorded the highest value ranging between (28-30) μm and an average of (29) μm . While the species *Cyperus difformis* was distinguished by being the record of the lowest value, which ranged between (12-17.5) μm and at a rate (13) μm , and thus it separated from the rest of the species and was completely isolated from it, As for the rest of the species, they overlapped with each other. Table (2) Panel (1). And the characteristic of the length of the equatorial axis of the pollen grain was also studied, as the species *Cyperus rotundus* was distinguished as recording the highest value of the length of the equatorial axis, which isolated it from the rest of the species and separated from it, as it ranged between (33-42.5) μm and an average of (37.75) μm , while the lowest value for the length of the equatorial axis It was distinguished by the species *Cyperus difformis* which helped to isolate and separate it from the rest of the species in the values of this characteristic, as it ranged between (16-20) μm and at the rate of (18) μm , and the rest of the species overlapped in the average values recorded. Table (2) Panel (1). The ratio of the length of the polar axis to the equatorial axis was also studied, as the species *Carex pachystylis* recorded the highest ratio, which amounted to (0.84), while the species *Cyperus difformis* recorded the lowest ratio, which amounted to (0.72). Among the characteristics that were also studied was the number of pollen grain aperturate, as we note from Table (2), Panel (1) that the species *Cyperus difformis* was distinguished by (5) aperturate, while the rest of the species were divided into two groups. The first group had the number of pollen aperturate in it (4) aperturate, which it was represented by the species *Carex diluta* and *Carex pachystylis*, while the second group was the number of openings (4 - 5) aperturate, which was represented by the species *Cyperus odoratus* and *Cyperus rotundus*.

Table (1) Quantitative and qualitative traits of pollen for the studied species

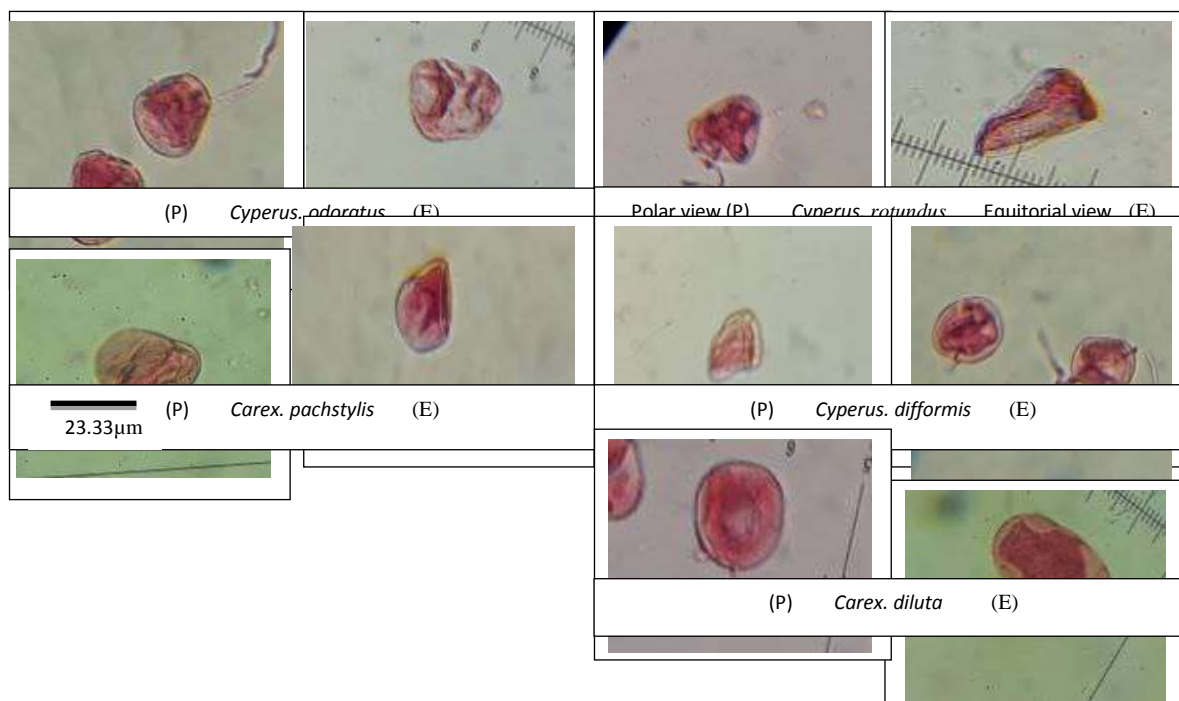
Species \ Traits	Shape pollen in Equitorial view (E)	Shape pollen in Polar view (P)	Shape of pollen	Pollen layer under microscope	
				clear	dark

Carex pachystylis	Peariform	Rhomboidal	Sub Oblate	-	+
Carex diluta	Rectangular	Circular	Sub Oblate	+	-
Cyperus rotundus	Rectangular Triangular	Rhomboidal Triangular	Sub Oblate	+	-
Cyperus difformis	Triangular	Circular	Oblate Spheroidal	+	-
Cyperus odoratus	Rhomboidal	Rhomboidal Triangular	Sub Oblate	-	+

* Numbers outside the parentheses represent the upper and lower bounds, and the numbers in the parentheses represent the average.

Table (2) Quantitative triats of pollen for the studied species

Species \ Triats	Length of polar axis(μm) (P)	Length of equatorial axis(μm) (E)	RateP/E	Number of aperture	Thickness of the Exine layer (μm)
Carex pachystylis	20(23.33)27	20(27.5)32.5	0.84	4 Aperture	4(3.1)2.5
Carex diluta	17.5(22)25	25(28.33)32.5	0.77	4 Aperture	2.5(2.3)2
Cyperus rotundus	28(29)30	33(37.75)42.5	0.75	4-5 Aperture	3.5(3.3)3
Cyperus difformis	12(13)17.5	16(18)20	0.81	5 Aperture	3(2.7)2
Cyperus odoratus	17.5(20.5)24.5	20(25)30	0.82	4-5 Aperture	5(3.7)3.5



Panel (1) Variations in the dimensions and shapes of pollen grains in the studied species
(40x)

4. DISCUSSION

The current study dealt with two genus of the cyperaceae family, namely the genus *Carex* and the genus *Cyperus*. Due to the overlap in some phenotypic traits, especially the vegetative traits, the study focused on studying the micromorphology characteristics of the pollen grains of the genera under study, which shows the proximity or remoteness of the species to each other. The characteristics of the pollen grains in terms of their dimensions, shapes, and number of germination holes showed significant importance in separating the species from each other, as the characteristic of the shape of the pollen grain in the equatorial view showed a variation between the species, where the species *Carex pachystylis* was distinguished in Peariform shape, while the species *Cyperus. odoratus* in the Rhombiodal shape, and the species *Cyperus difformis* in the triangular shape. As for the rest of the species, their shapes ranged from the Rectangular - Triangular rectangle, included the species, *Carex diluta* and *Cyperus rotundus*. This agreed with the study of [13] and [14]. As for its shape in the polar view, its shapes also showed a variation between the species, as the species *Carex pachystylis* was distinguished by the Rhombiodal shape that isolated it from the rest of the species, which was divided into two groups, The first was circular in shape, which included the species *Carex diluta* and *Cyperus difformis*, while the second group was the shape of pollen Rhombiodal Triangular which included the species, *Cyperus rotundus* and *Cyperus. odoratus*, The study did not agree with regard to the species *Cyperus rotundus* of the shape of pollen grains in the polar view with [15] mentioned, which mentioned that its shape is circular, while the current study showed that its shape is Rhombiodal Triangular, but it agreed with the study of [13] and [14]. As for the thickness of the outer layer of the pollen grain, it was observed that the species *Cyperus. odoratus* recorded the highest value for the thickness of the wall, which distinguished it from the rest of the species, and this is consistent with the study of [13], While the species *Carex diluta* recorded the lowest rate of wall thickness, the rest of the species were overlapping with each other. The transparency of pollen grains under the microscope was also studied, where the species were divided according to their transparency into two groups: the first clear or thin, which included the species *Carex diluta*, *Cyperus rotundus* and *Cyperus difformis* and the second group dark, which included the species *Cyperus odoratus* and *Carex pachystylis* which it agreed with [13]. It was also observed through the length of the polar axis that the species *Cyperus rotundus* was distinguished as having the highest rate of about (29) μm , which isolated it from the rest of the species, while the lowest rate was recorded for the species *Cyperus difformis*, which amounted to about (13) μm . These rates were close to what [13] mentioned and contrary to what [15] mentioned. As for the rest of the species, they overlapped with each other in their rates. As for the length of the equatorial axis, it was also of taxonomic importance in distinguishing some species and isolating them from each other, Where it was observed that the species *Cyperus rotundus* distinguished itself as having the highest rate about (37.75) μm , while the lowest rate was distinguished by the species *Cyperus difformis*, which amounted to about (18) μm . These rates were close to what each of them mentioned [20] and [21]. As for the P/E ratio, it was noted that my ratio was recorded by the species *Carex pachystylis*, while the species *Cyperus rotundus* recorded the lowest ratio, and this ratio was close to what [14] mentioned. As for the number of holes of germination, it was noticed that the species *Cyperus difformis* was distinguished by having (5) aperturate, which distinguished it from the rest of the species, and this agreed with the study of [13], while the number of holes of germination ranged between (4-5) aperturate in the two species *Cyperus rotundus* and

Cyperus odoratus, which agreed with the study of [14], while the number of germination holes in the two species *Carex pachystylis* and *Carex diluta* was (4) aperturate, and this agreed with the [14] study.

5. CONCLUSIONS

We conclude from this research that the studied Micromorphology characteristics of pollen grains the studied species showed a clear contrast that helped separate the species and isolate them from each other and know how close or far the species are from each other. The current study also reported knowing the exact pollen characteristics of the species under study, and determining which of the studied traits are of taxonomic importance and which of them were not of taxonomic importance, which helps future studies in developing a taxonomic key for the studied species to separate them from each other.

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